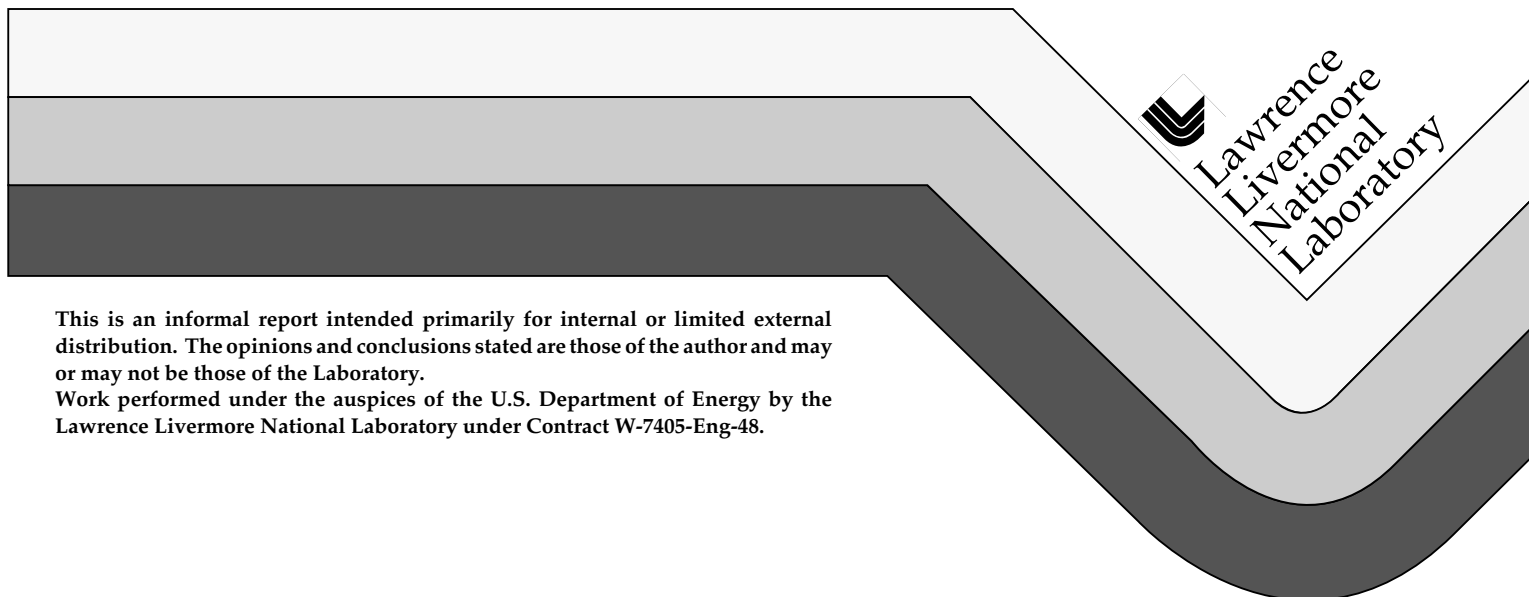


**Second U.S. Department of Energy Workshop on
Heavy Vehicle Aerodynamic Drag:
Presentations and Summary of Comments and Conclusions**

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March 6, 1998



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Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

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Jointly written by

**Lawrence Livermore National Laboratory
Sandia National Laboratories
University of Southern California
California Institute of Technology
NASA Ames Research Center**

Introduction

The Second U.S. Department of Energy (DOE) Workshop on Heavy Vehicle Aerodynamic Drag was held at Lawrence Livermore National Laboratory (LLNL) on February 20, 1998. This was a follow-on workshop to the first workshop held in Phoenix, Arizona on January 30-31, 1997. The DOE sponsor is Dr. Sidney Diamond of DOE's Office of Transportation Technology (OTT). Office of Heavy Vehicle Technology (OHVT).

The purpose of the second workshop was to present a Multi-Year Program Plan (MYPP) to participants from industry, universities, NASA, and National Labs. The proposed multi lab, multi-university effort was described in technical presentations given by representatives from LLNL, Sandia National Laboratories (SNL), University of Southern California (USC), California Institute of Technology (Caltech), and NASA Ames Research Center. These presenters are part of a DOE appointed Technical Team assigned to developing the MYPP. The dinner presentation was given by David Nowak, LLNL's Program Leader for Accelerated Strategic Computing Initiative (ASCI).

The goal of the MYPP is to develop and demonstrate the ability to simulate and analyze aerodynamic flow around heavy truck vehicles using existing and advanced computational tools (A Multi-Year Program Plan for the Aerodynamic Design of Heavy Vehicles, R. McCallen, D. McBride, W. Rutledge, F. Browand, A. Leonard, J. Ross, UCRL-PROP 127753 Dr. Rev 1, February 1998).

This report contains the technical presentations (viewgraphs) delivered at the Workshop, briefly summarizes the comments and conclusions from the Workshop participants regarding the MYPP, and outlines the future action items.

The MYPP and Workshop Presentations

As described in the viewgraph presentations, the project plan is divided into three related and overlapping efforts:

Advanced Computations and Experiments of Benchmark Geometries

Demonstration of a Device Integration Process

Evaluation of Current and New Technologies

Each effort has near-term deliverables as well as longer-term goals. The computations and experiments effort will provide rapid results for simple benchmark geometries, and will then advance to more complex geometries. The demonstration of a 'simulation through testing through device integration' process for an existing trailer add-on device will be a near-term effort, with the promise for a long-term impact. The evaluation of current and new technologies will contribute to the choice of the trailer add-on for the demonstration and thereafter will continue to provide assessment for promising emerging technology.

The following is a list of the presentations delivered at the Workshop and enclosed herein.

Opening Remarks

Sidney Diamond, US DOE, OTT, OHVT, Heavy Vehicle Systems Technology

Update: Background on Development of Draft MYPP, Introduction of Technical Committee, Conclusions from Site Visits

Rose McCallen, Lawrence Livermore National Laboratories

Computations and Experiments

Reynolds-Averaged Navier Stokes (RANS) Modeling

Walt Rutledge, Sandia National Laboratories

Large-Eddy Simulation (LES) using Finite Element Methods

Rose McCallen, Lawrence Livermore National Laboratories

Vortex Methods

Anthony Leonard, California Institute of Technology

Generic Shapes & Experiments

Fred Browand, University of Southern California

Evaluation of Current and New Technologies

Fred Browand, University of Southern California

Heavy Vehicle Testing/Flow Characteristics, Plate Vortex Generators

James Ross, NASA Ames Research Center

Demonstration of Device Integration

Don McBride, Sandia National Laboratories

Summary Comments and Conclusions

Overall the participants were pleased with the presentation of the MYPP. The majority of the comments were focused on specific verbiage missing in the MYPP document and on issues of technology transfer. More specifically it was felt that the document did not clearly state the benefits of the MYPP for the tractor manufacturers through the computational and experimental effort, even though the Technical Team had clearly stated the benefits in their presentations.

Through a panel discussion, the specific additions or modifications of tasks and deliverables to the MYPP were outlined. The comments by the Workshop participants and conclusions are as follows:

1. State the goals and deliverables clearly in the MYPP and define terms.

a) Mention relevance of goals and deliverables to improve both tractor aerodynamics and integrated tractor/trailer aerodynamics.

In the computational and experimental effort description, state that the 'generic' shapes will address tractor aerodynamics and the integrated tractor/trailer aerodynamics. The evaluation of new and current technology section should state that tractor issues will be addressed as well as tractor/trailer integration issues. For example, at least one of the generic problems should focus on trailer/tractor gap flow.

b) Clearly state in the MYPP that the final products are validated CFD tools. Then be sure to defined what is meant by tools.

The 'CFD tools' are not only the actual computer codes, but descriptions of appropriate numerical solution methods. The delivery of actual codes will be restricted by normal Laboratory and University policies and all collaborative requirements will have to be met before delivery of software to project collaborators. Part of the project effort will be to determine the restrictions or avenues for technology transfer (see next comment).

2. The technology transfer issue must be addressed.

A plan for technology transfer will be included in the MYPP

3. More input from fleet operators is needed.

The Technical Team Leader, Rose McCallen, has had several phone conversations with one major fleet operator for guidance in development of the MYPP, but a site visit to their facility was not possible. The MYPP will include site visits to one or more fleet operators.

4. Discuss other related projects.

The MYPP does mention several new technology areas and other related projects. I was suggested that the MYPP also include discussions on:

- The role of system analysis
- Economic drivers that affect energy consumption in introduction section of MYPP
- Issues of full scale Reynolds number wind tunnel tests.

Action Items

The follow-on action items are to make the required modifications to the MYPP and to scope out the project cost, timeline, and to set project milestones. The specific changes to the MYPP were described in the previous section.